Chelated Iron Corrects Chlorosis of Gardenias

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Chlorosis in gardenias was corrected at a soil temperature of 50°F when chelated iron was added to the soil. Similar applications of ferrous sulfate or ammonium sulfate, however, were not effective in correcting the chlorosis. Thus chlorosis in gardenias can be corrected by an application of chelated iron without raising the temperature of the soil.

When gardenias are grown at low soil temperatures the roots have difficulty obtaining iron from the soil and as a consequence the leaves become chlorotic. The purpose of this work was to find out whether or not chelated iron, applied to the soil, would correct chlorosis of gardenias growing at low soil temperatures. Normally chlorosis can be prevented by growing the plants at high soil and air temperatures (65° to 70°F); however, high air temperatures will increase bud drop. Thus, the grower may have trouble with chlorotic foliage or bud drop depending on the growing temperatures. Since bud drop is generally more important that chlorosis, gardenias are normally grown between 60° and 65°F, and chlorosis may present a problem.

The cause of iron chlorosis has been stated by several investigators to be the result of some malfunction of the plant or improper environmental conditions. These factors alone or in combination may induce chlorosis, but are not the cause. These investigators state that the real cause of chlorosis is a lack of sufficient soluble iron in the leaves. This deficiency may be due to the inability of the plant roots to absorb the iron from the soil or to the lack of, or unavailability of, iron in the soil. Chlorosis may also result because the iron cannot be translocated to the leaves even after it is absorbed by the roots.

EXPERIMENTAL

Gardenia plants in the first experiment were grown in soil temperatures of 50°, 60° and 70°F and in combinations with three air temperatures: 50°, 60° and 70°F. One half of the plants in each treatment received an application of chelated iron (Fe–EDTA). This material was obtained in powder form and contained 13% Iron as Fe or 18.5% Iron as ferric oxide. Two grams of the chelated iron were dissolved in a liter of water, and each plant received 100 ml of this solution (equivalent to 14 ounces per 100 square feet of bench). Soil temperatures which were higher than air temperatures were controlled by heating cable and soil thermostats.

The increase in the total number of leaves and the increase in chlorotic leaves from the start to the end of the experiment was measured. Bud drop, flower production, and the quality of the flowers were also noted.

Table 1 gives the average number of leaves produced from the start of the experiment for all twelve treatments. This table shows that all treatments receiving chelated iron except 70° Air – 70° Soil produced more leaves than those treatments not receiving chelated iron. It is also evident that plants receiving chelated iron at 60° Air–70° Soil produced the greatest number of leaves.

TABLE 1. Average number of leaves and average increase in the number of chlorotic leaves produced on gardenia cuttings from March 3, 1956 to June 4, 1956:

	Chelated Iron Added		*No Iron Added*	
	Av. No. of Lvs.	Av. No. of Chlorotic Leaves	Av. No. of Lvs.	Av. No. of Chlorotic Leaves
50° Air – 50° Soil	10.0	3.2	4.2	12.6
50° Air – 60° Soil	13.4	9.8	7.3	9.8
50° Air – 70° Soil	23.6	9.8	17.6	5.8
60° Air – 60° Soil	46.4	2.0	34.8	19.6
60° Air – 70° Soil	52.4	0.0	45.0	14.6
70° Air – 70° Soil	39.6	0.4	45.0	12.2

Table 1 also gives the average increase in the number of chlorotic leaves produced. This increase was obtained by subtracting the amount of chlorotic leaves present on plants on March 3, 1956 from the amount present on June 4, 1956. In all treatments receiving chelated iron, except 50° Air–70° Soil, the number of chlorotic leaves produced was less than in those treatments not receiving chelated iron. There was no increase in the number of chlorotic leaves produced by the plants receiving chelated iron at 60° Air–70° Soil.

The second experiment was designed to determine whether chelated iron would correct chlorosis at a soil temperature below the existing air temperature. Plants were given soil temperatures of 50° and 60°F at a 60°F minimum air temperature. Soil temperatures which were cooler than air temperatures were maintained in a constant temperature refrigerated water bath. In order to maintain temperature control in the water bath, only a small number of plants could be used in this experiment. The plants were grown in asphalt painted containers and were watered by subirrigation.

Table 2 gives the average increase in the number of leaves produced for the four treatments of the experiment The plants in the two treatments with a 60°F soil temperature produced more leaves than the plants in the two treatments receiving a 50°F soil temperature. Plants receiving chelated iron at 50°F soil temperature, however, did not produce as many leaves as did the plants at the same temperature not receiving chelated iron.

The average increase in the number of chlorotic leaves is also presented in Table 2. Plants not receiving chelated iron at 50°F soil temperature showed the greatest increase in the number of chlorotic leaves. This increase exceeded the average increase in the number of leaves

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Chelated Iron . . . (*continued from page 2*)

produced. Thus all leaves produced by plants of this treatment became chlorotic, and those leaves which were green at the start of the experiment became chlorotic.

TABLE 2. Average number of leaves and average increase in the number of chlorotic leaves produced by gardenia plants grown at 60° minimum air and 50° or 60° soil temperatures with and without chelated iron from June 30, 1956 to August 22, 1956.

	Chelated Iron Added		*No Iron Added*	
	Av. No. of Lvs.	Av. No. of Chlorotic Lvs.	Av. No. of Lvs.	Av. No. of Chlorotic Lvs.
50° Soil	23.8	1.2	36.6	43.2
60° Soil	47.5	0.0	37.5	13.0

The plants receiving chelated iron at 50° soil temperature showed a very slight increase in the number of chlorotic leaves, whereas, the plants at a 60° soil temperature receiving chelated iron did not show an increase. Also evident from Table 2 is the fact that an increase in soil temperature resulted in a decrease in the number of chlorotic leaves.

DISCUSSION

Plants grown at 50°F air temperature, regardless of soil temperature, made very little growth when compared to plants grown at 60° and 70°F air temperature.

An increase in soil temperature at each air temperature resulted in an increase in the number of leaves produced. At 60°F air temperature an increase in soil temperature resulted in a decrease in the number of chlorotic leaves produced. This relationship was not observed at 50°F air temperature.

The addition of chelated iron had a great effect on the production of leaves and the correction of chlorosis at 60° and 70°F air temperatures. The plants grown at a 60°F air temperature and a 70° soil temperature which received chelated iron gave the largest increase in the number of leaves. These plants did not produce any chlorotic leaves.

A high soil and air temperature (70° Air–70° Soil) was not completely effective in correcting chlorosis as has been reported. Those plants which received chelated iron and grown at 70°F Air and 70°F Soil temperatures did not, however, develop chlorosis.

New leaves produced on plants at 50°F Soil temperature were much smaller than new leaves produced on plants at 60°F and 70°F soil temperatures and these leaves never did reach normal size.

More flowers and buds were produced by plants treated with chelated iron. Many flowers and buds produced by the untreated plants were small and of inferior quality. Bud drop did not occur at 50° or 60°F air temperatures, but did occur at 70°F.

Chlorosis was corrected even at a soil temperature of 50°F when chelated iron was added to the soil. Plants not receiving chelated iron remained chlorotic even at a soil temperature of 60°F during periods of low light intensity. This was apparently due to the effect of lessened carbohydrate production on root growth, which in turn governs the amount of water and nutrients absorbed.

Chelated iron is leached from the soil. One application will last from two to six months depending on the amount of water being applied. It was found that approximately one-third of the chelated irion added to the soil was leached within three weeks after application.

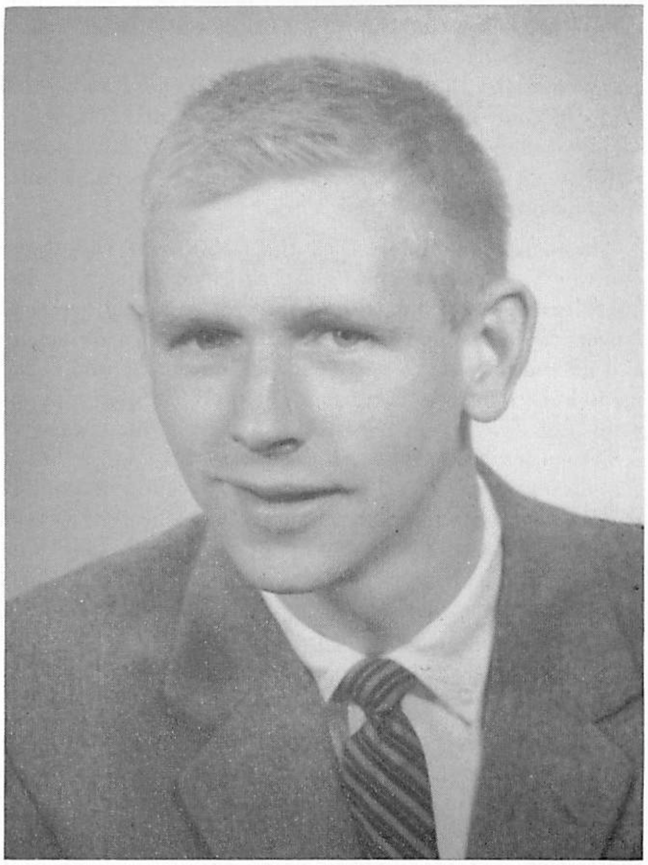
Injury to the plants will result if chelated iron is either sprayed on the foliage or applied to the soil in powder form (in amounts exceeding .04 grams per four inch pot). No injury was observed when liquid applications were made to the soil.

RECOMMENDATIONS

1) Chelated iron should be applied in a water solution at the rate of 0.2 grams per four inch pot or 14 ounces per 100 square feet of bench. If sprayed on the foliage or applied to the soil in powder form, injury may result.

2) Chelated iron should be applied whenever the young leaves display chlorosis. Plants will begin to "green up" within two weeks after application. If the foliage remains green, repeated applications are unnecessary.

Miller Joins Ohio



Robert O. Miller completed his Ph.D. this past Sepber and has accepted a research teaching position in Ohio. Bob will be doing research in floriculture at the Wooster Experiment Station and teaching some floriculture courses at Ohio State University.

Bob is a native of West Virginia and received his Bachelor of Science from the University of West Virginia. He came to Cornell in 1954 and wrote his Masters thesis on the effect of soil temperature on the growth of stocks. His Ph.D. thesis was written on the effect of light intensity and temperature on the growth of snapdragons.

We are all sorry to see Bob leave New York, but we wish him and his family the best of success.